CNS/ATM for Naval Aviation

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Volume 4, Issue 1, January 11, 2002

Purpose

This newsletter provides information to the Naval aviation community on civil initiatives in Communications, Navigation and Surveillance / Air Traffic Management (CNS/ATM).

SURVEILLANCE

ADS-B Data Link Proposed Decision

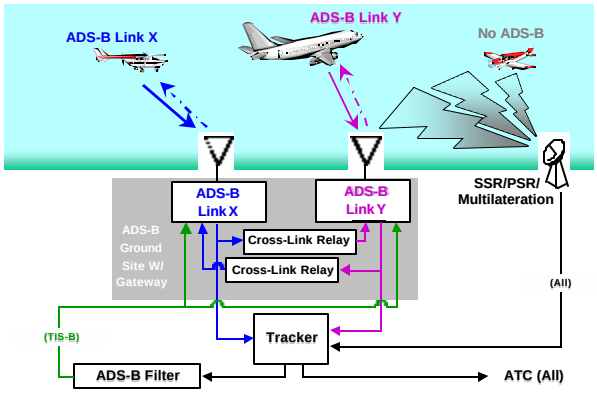
After careful consideration, the FAA is proposing that two data links be implemented for Automatic Dependent Surveillance – Broadcast (ADS-B) here in the U.S. For air carriers flying in high altitude airspace, they are proposing Mode S (which they identify as 1090 Extended Squitter – 1090ES). For General Aviation (GA), they have proposed the Universal Access Transceiver (UAT). In a previous newsletter, it was noted than none of the candidate data links satisfied all of the required performance criteria.

The FAA expects that all air carriers will equip with 1090ES for ADS-B, and for Traffic Information Services – Broadcast (TIS-B) service. For short-range air-to-air ADS-B applications, the FAA notes that 1090ES provides 40 nmi coverage in high density and high interference environments. The range increases to 90 nmi in low density / low interference conditions.

The FAA expects that between 40 to 70 % of the GA will equip with UAT for ADS-B, TIS-B, and Flight Information Services – Broadcast (FIS-B) service. FIS-B is expected to provide graphical or text weather information. UAT provides coverage similar to 1090ES. Both links are expected to provide up to 200nmi air-to-ground ATC surveillance communications coverage.

The FAA expects that most aircraft will equip with a single link. Some aircraft, possibly the high-end GA business jet user or the commuter regional jet may equip with both links. Since 1090ES and UAT operate on different frequencies and use different data message formats, the FAA is committed to developing a ground infrastructure that provides both a cross link relay as well as traffic information for non-equipped aircraft. One possible functional architecture for the gateway is shown in the diagram below.

Functional Architecture for ADS-B Gateway (With TIS-B)



The FAA rationale for the two link solution can be deduced. Air carriers operating in high altitude airspace are under a FAA mandate to carry Traffic Alert and Collision Avoidance Systems (TCAS). TCAS is also a Mode S based system that uses a different message format. Therefore, the cost to equip and the time to equip may be reduced. Based upon experience in Alaska, UAT with FIS-B led to a marked reduction in accidents. With sufficient production quantities, the UAT becomes affordable for the cost conscious GA owner – operator. Therefore, a reduced cost to equip may lead to improved GA safety.

However, the two link solution introduces some issues. The most obvious issue is the lack of direct communication between the two data links. ADS-B provides a false sense of situational awareness security. A cross country high altitude pilot, accustomed to seeing all traffic on the display, may forget on final approach that GA traffic is squawking on a different frequency.

This leads to another issue. TIS-B is expected to provide traffic data on non-equipped or differently equipped aircraft. But the ground gateway concept introduces an additional airspace system that could fail. Also, a problem exists today

with “airspace holes” in ground surveillance radar coverage. A similar problem occurs with the ground gateway concept. These areas of non-coverage will lessen, but not disappear, using ADS-B.

An even larger issue of information latency exists. The FAA assumes that cross-link relay processing via the gateway will consume one second. The period of the ground surveillance radar sweep may be up to 10 seconds. Both sets of data will be provided via TIS-B. Therefore, traffic location data may be deceptive. Situational awareness depends upon accurate and timely information.

Global harmonization is an issue. Europe has not selected an ADS-B link or links. Past statements from individual European national representatives have not been favorable to UAT. Europe may make a link decision late this year. Australia is conducting evaluations on a Mode S ADS-B solution. Sweden, Russia, and Papua New Guinea have adopted the VHF Data Link Mode 4 (VDL-4) as their ADS-B data link. Global consensus on which link or links to be implemented has not been reached. The FAA is committing to achieving global interoperability in an ADS-B data link. For DOD aircraft, in general, and Navy aircraft, in particular, world wide missions and ad hoc coalitions dictate the necessity of safe transit in any airspace and safe operations with any partner.

As part of the proposed two data link solution, the FAA discussed plans for rule making and schedules. The proposed two-link solution will be reviewed by the RTCA Free Flight Steering Committee, a panel with members from all facets from the aviation industry with an interest in implementing CNS/ATM. The Committee is expected to make a recommendation to the FAA Administrator in March 2002. The Committee will note that the FAA is relying on voluntary equipage by users. They also will note that the FAA does not expect to complete the installation of ground infrastructure throughout the National Airspace prior to 2010. In 2010, the FAA expects that air carriers will have also completed implementing the data link on their aircraft. After 2010, the FAA may institute rule making action to require aircraft operating in high altitude airspace or in high density / high interference airspace to be suitably equipped. Based upon precedents, if Europe makes a link decision in 2002, it is expected that their national mandates would not require equipage prior to 2010.

Previously, DOD provided to the FAA rough order of magnitude estimates of the cost to equip for the various candidate data links and combinations of the links. These estimates include procurement, installation, and sustainment through 2025. For DOD, equipping with 1090ES costs nearly $7 billion, with UAT nearly $10 billion, and with both over $10 billion. In providing the estimates, DOD did not make any commitment to equip.

CNS/ATM NEWS

RVSM Implentation Imminent

Implementation of Reduced Vertical Separation Minimum (RVSM) occurs on 24 January 2002 in European airspace. From flight level 290 to flight level 410, the vertical separation between aircraft decreases from 2000 feet to 1000 feet. To participate, an aircraft shall be equipped with:

- two independent cross-coupled altitude measuring systems (barometric),
- an altitude reporting transponder,
- an altitude alerting system (± 300 feet/ uncertainty of 50 feet), and
- an automatic altitude control system (± 65 feet).

Most civil aviation authorities have exempted military aircraft from meeting these requirements. However, this exemption does not mean that military aircraft may not be excluded or delayed due to safety or traffic conditions.

The map below shows the RVSM area.

In addition, on 24 January 9, 2002 for the same flight levels, the nation of Belarus will also implement RVSM in the Minsk Flight Information Region. All sectors in the North Atlantic will extend RVSM to the same flight levels and routes in the South Atlantic will go RVSM as well.

Hard on the heels of Europe is implementation of RVSM in the Western Pacific and South China Sea on 21 February 2002. It also will be at the same flight levels. There will restrictions imposed on non RVSM aircraft. When Canada implements RVSM on its Northern routes on 18 April 2002 at the same flight levels, a passenger on a commercial airline will be able to fly from Sydney to Minsk via North America and be in RVSM airspace for the entire trip.